

1 What is claimed is:

2 1. A biomass gasifier apparatus, comprising:

3 (A) a fuel input system;

4 (B) a gasifier cell, receiving fuel from the fuel input system; and

5 (C) whereby heated gas is supplied to the gasifier cell, and a mixture of gases, char
6 and ash is exhausted from an upper portion of the gasifier cell.

7
8 2. The biomass gasifier apparatus of claim 1, wherein the gasifier cells comprises a
9 fluidized bed gasifier cell, comprising:

10 (a) bed material, carried at the base of the fluidized bed gasified cell;

11 (b) a fluidizing gas plenum, carried within the fluidized bed gasifier cell;

12 (c) a plurality of manifolds, arranged within the fluidized bed gasifier cell, whereby a
13 space is sufficient between adjacent manifolds to allow tramp material to pass
14 downwardly; and

15 (d) a plurality of nozzles are supported by each manifold, whereby gas released by
16 the nozzles fluidizes the bed material.

17
18 3. The biomass gasifier apparatus of claim 2, additionally comprising:

19 (A) a cyclone, having an input in communication with the fluidized bed gasifier cell,
20 for receiving a mixture of gases, char and ash from an upper portion of the
21 fluidized bed gasifier cell, and for separating the mixture into first and second
22 outputs, comprising a first output exhausting a mixture of low BTU gas, and a
23 second output exhausting gas carrying a mixture of ash and char.

24
25 4. The biomass gasifier apparatus of claim 2, additionally comprising:

26 (A) a bed change-out system, in communication with the fluidized bed gasifier cell,
27 for removing tramp, clinkers and other waste from the bed material.
28

- 1 5. The biomass gasifier apparatus of claim 1, additionally comprising:
- 2 (a) a primary gas clean-up system, having an input attached to the gasifier cell,
- 3 whereby output from the fluidized bed gasifier cell is enhanced by the removal of
- 4 char and ash from the gas.
- 5
- 6 6. The biomass gasifier apparatus of claim 5, additionally comprising:
- 7 (A) a char combustion cell, having an input connected to the second output of the
- 8 high-temperature gas clean-up system, oxidizes the char at elevated
- 9 temperatures.
- 10
- 11 7. The biomass gasifier apparatus of claim 6, additionally comprising:
- 12 (A) a heat exchanger, having a first input connected to an output of the char
- 13 combustion cell, receives gas leaving the char combustion cell and removes heat
- 14 energy.
- 15
- 16 8. The biomass gasifier apparatus of claim 7, additionally comprising:
- 17 (A) a secondary gas cleanup unit, having an input connected to a first output of the
- 18 heat exchanger, receives gases discharged from the char combustion cell that
- 19 have been cooled by the heat exchanger, and removes ash from the gas and
- 20 exhausts cleaned gas through an output.
- 21
- 22 9. The biomass gasifier apparatus of claim 8, wherein the secondary gas cleanup unit
- 23 comprises a cyclone.
- 24
- 25 10. The biomass gasifier apparatus of claim 9, wherein the secondary gas cleanup unit
- 26 comprises a multi-clone.
- 27
- 28

- 1 11. The biomass gasifier apparatus of claim 9, wherein the secondary gas cleanup unit
2 comprises a electrostatic precipitator.
3
- 4 12. The biomass gasifier apparatus of claim 4, wherein the secondary gas clean-up system
5 comprisès:
6 (A) a cyclone, having an input in communication with the gasifier cell, for receiving a
7 mixture of gases, char and ash from an upper portion of the gasifier cell, and for
8 separating the mixture into first and second outputs, comprising a first output
9 exhausting a mixture of low BTU gas, and a second output exhausting gas
10 carrying a mixture of ash and char.
11
- 12 13. The biomass gasifier apparatus of claim 12, additionally comprising:
13 (A) a char combustion cell, having an input connected to the second output of the
14 cyclone, oxidizes the char at elevated temperatures.
15
- 16 14. The biomass gasifier apparatus of claim 13, additionally comprising:
17 (A) a heat exchanger, having a first input connected to an output of the char
18 combustion cell, receives gas leaving the char combustion cell and removes heat
19 energy.
20
21
22
23
24
25
26
27
28

1 15. The biomass gasifier apparatus of claim 14, additionally comprising:
2 (A) a secondary gas cleanup unit, having an input connected to a first output of the
3 heat exchanger, receives gases discharged from the char combustion cell that
4 have been cooled by the heat exchanger, and removes ash from the gas and
5 exhausts cleaned gas through an output.
6

7 16. The biomass gasifier apparatus of claim 15, wherein the secondary gas clean-up system
8 comprises:
9 (A) a multi-clone unit.
10

11 17. The biomass gasifier apparatus of claim 15, wherein the secondary gas clean-up system
12 comprises:
13 (A) a cyclone.
14

15 18. The biomass gasifier apparatus of claim 15 wherein the secondary gas clean-up system
16 comprises:
17 (A) a ceramic filter.
18

19 19. The biomass gasifier apparatus of claim 15, wherein the secondary gas clean-up system
20 comprises:
21 (A) a baffle device.
22
23
24
25
26
27
28

1 20. The biomass gasifier apparatus of claim 14, additionally comprising:

- 2 (A) a fluid bed gasifier fan, having an input connected to the output of the gas
3 cleanup unit, forces a gas mixture of the cleaned gas from the gas cleanup unit
4 and additional gas at high pressure into a second input of the heat exchanger,
5 wherein the gas mixture is heated, exhausted from a second output of the heat
6 exchanger, and delivered to the fluidizing gas plenum of the fluid bed gasifier cell.

7
8
9
10 21. A biomass gasifier apparatus, comprising:

- 11 (A) a fuel input system;
12 (B) a fluidized bed gasifier cell, receiving fuel from the fuel input system;
13 (C) whereby a mixture of gases, char and ash is exhausted from an upper portion of
14 the fluidized bed gasifier cell;
15 (D) a cyclone, having an input in communication with the fluidized bed gasifier cell,
16 for receiving a mixture of gases, char and ash from an upper portion of the
17 fluidized bed gasifier cell, and for separating the mixture into first and second
18 outputs, comprising a first output exhausting a mixture of low BTU gas, and a
19 second output exhausting gas carrying a mixture of ash and char; and
20 (E) a char combustion cell, having an input connected to the second output of the
21 cyclone, oxidizes the char at elevated temperatures; and
22 (F) whereby gas heated within the char combustion cell is use to fluidize the fluidized
23 bed gasifier cell.

- 1 22. A biomass gasifier apparatus, comprising:
- 2 (A) a fuel input system;
- 3 (B) a fluidized bed gasifier cell, receiving fuel from the fuel input system, comprising:
- 4 (a) bed material, carried at the base of the fluidized bed gasified cell;
- 5 (b) a fluidizing gas plenum, carried within the fluidized bed gasifier cell;
- 6 (c) a plurality of manifolds, arranged within the fluidized bed gasifier cell,
- 7 whereby a space is sufficient between adjacent manifolds to allow tramp
- 8 material to pass downwardly; and
- 9 (d) a plurality of nozzles are supported by each manifold, whereby gas
- 10 released by the nozzles fluidizes the bed material; and
- 11 (C) a bed change-out system, in communication with the fluidized bed gasifier cell,
- 12 for removing tramp, clinkers and other waste from the bed material;
- 13 (D) a cyclone, having an input in communication with the fluidized bed gasifier cell,
- 14 for receiving a mixture of gases, char and ash from an upper portion of the
- 15 fluidized bed gasifier cell, and for separating the mixture into first and second
- 16 outputs, comprising a first output exhausting a mixture of low BTU gas, and a
- 17 second output exhausting gas carrying a mixture of ash and char;
- 18 (E) a char combustion cell, having an input connected to the second output of the
- 19 cyclone, oxidizes the char at elevated temperatures;
- 20 (F) a heat exchanger, having a first input connected to an output of the char
- 21 combustion cell, receives gas leaving the char combustion cell and removes heat
- 22 energy;
- 23 (G) a gas cleanup unit, having an input connected to a first output of the heat
- 24 exchanger, receives gases discharged from the char combustion cell that have
- 25 been cooled by the heat exchanger, and removes ash from the gas and exhausts
- 26 cleaned gas through an output; and
- 27 (H) a fluid bed gasifier fan, having an input connected to the output of the gas
- 28 cleanup unit, forces a gas mixture of the cleaned gas from the gas cleanup unit

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28

and additional gas at high pressure into a second input of the heat exchanger, wherein the gas mixture is heated, exhausted from a second output of the heat exchanger, and delivered to the fluidizing gas plenum of the fluid bed gasifier cell.